A Thesis/Project/Dissertation Report

on

Smart Irrigation In Agriculture

Submitted in partial fulfillment of the
requirement for the award of the degree of

Bachelor Of Computer Science And Engineering

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

Under The Supervision of
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SCHOOL OF COMPUTING SCIENCE AND ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
GALGOTIAS UNIVERSITY, GREATER NOIDA , INDIA
12, 2021

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1. CANDIDATE'S DECLARATION

We hereby certify that the work which is being presented in the thesis/project/dissertation, entitled **"Smart Irrigation In Agriculture"** in partial fulfillment of the requirements for the award of the Bachelor of Technology in Computer Science submitted in the School of Computing Science and Engineering of Galgotias University, Greater Noida, is an original work carried out during the period of month, Year to Month and Year, under the supervision of Mr. G.Nagarajan Assistant Professor, Department of Computer Science and Engineering/Computer Application and Information and Science, of School of Computing Science and Engineering , Galgotias University, Greater Noida

The matter presented in the thesis/project/dissertation has not been submitted by us for the award of any other degree of this or any other place.

Paras Saini, 19SCSE1010122

Amit Prakash,19SCSE1010118

This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Mr. G.Nagarajan
Assistant Professor

CERTIFICATE

The Final Thesis/Project/ Dissertation Viva-Voce examination of Paras Saini, 19SCSE1010122 and Amit Prakash, 19SCSE1010118 has been held on _____ and their work is recommended for the award of Degree of Bachelor Of Technology in Computer Science.

Signature of Examiner(s) **Signature of Supervisor(s)**

Signature of Project Coordinator **Signature of Dean**

Date: 04/December/2021
Place: Greater Noida

Acknowledgement

We totally depend on agriculture, because agriculture provides us with the sources which are necessary for our survival and for our growth. We can say that our farmers are our precious gift for us as well as for our nation. They provide us food and help our country's economy to expand. I also come from a farmer family background and it’s a proud for me I have seen how a farmer worked hard in his field to grow crops so after getting my inspiration from farmers we decide to create technologies which will help our farmers by decreasing their efforts and help them to increase their yields when our farmers grow then our country grow and our economy expands. India totally depends on farmers. 80 to 90% of GDP comes from our farmers so this is my inspiration behind this work. I want to thank Mr. G.Nagarajan who helped us during the project and he was our project guide, he helped us whenever we needed. In developing this smart Irrigation IoT project for our agriculture it’ll help our farmers to save their time and irrigate their field automatically when the soil gets too dry. In this smart Irrigation project we have used sensors etc. Hope this project will help farmers to meet their goals and make farming easy for them. In the coming time in future we hope that our project will come into action and help our country. So we dedicate this project to our farmers and our grain producers who work whole year day night to grow grains to grow food for us.
Thank You.

Abstract

In India, spatial and temporal variation of precipitation has been boundless varying from 11000 mm to 90 mm. The average annual per capita water availability has declined from 5000 cubic meter in 1950 to 1545 cubic meter in 2011 and is estimated to reduce further to 1341 and 1140 cubic meter in 2025 and 2050, respectively.Agriculture sector, which provide 54.6% of total employment to growing population, alone consumes more than 90% of total groundwater draft in irrigation. Over the years, groundwater has become the dominant source of irrigation due to its independent access and timely availability of water. This outrageous dependency on groundwater has led to depletion of the water table in 64% of the country between TE2002 and TE2016. This is one of the areas of concern for us to develop an efficient time reduction technology which can help our farmers to provide full water support for irrigation. Irrigation is also a time taking process because when a farmer irrigate his field with the help of tubewell it needed full vigilance to check time to time that whole field has filled with water or not so that they can switch off the tubewell and stop the water to flow in the same field so in order to overcome this problem we come up with the solution of smart irrigation by creating an alert system on farmer device so that they can turn off the tubewell after the field is full of water it'll help to save water also and help to flow water into nearby field in which the farmer not want to give water. We will use sensor data to create the alert like soil moisture sensors who sense the moisture of the water and when the water level crosses the particular threshold it will create an alert so the farmer will stop the tubewell. It will also help farmers to overcome the problem of over irrigation which sometimes affects the growth of crops and decreases it's yielding due to which the farmer crops get damaged. So we hope that this technological development will help farmers to develop and make farming easy by the use of technologies.

CHAPTER-1

Introduction

Agriculture is our need. We need food for our survival and food comes from agriculture so agriculture is an important activity where we need development in our technologies and efficiency of work so that it increases the growth of our farmers' crops and meet our increasing population demand.

Agriculture is the primary source of livelihood for about 58% of India's population. Gross Value Added by agriculture, forestry, and fishing was estimated at Rs. 19.48 lakh crore (US$ 276.37 billion) in FY20. Share of agriculture and allied sectors in gross value added (GVA) of India at current prices stood at 17.8 % in FY20. Consumer spending in India will return to growth in 2021 post the pandemic-led contraction, expanding by as much as 6.6%.

The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year due to its immense potential for value addition, particularly within the food processing industry. The Indian food and grocery market is the world's sixth largest, with retail contributing 70% of the sales. The Indian food processing industry accounts for 32% of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth.

The total agricultural and allied products exports stood at US$ 41.25 billion in FY21.

The Economic Survey of India 2020-21 report stated that in FY20, the total food grain production in the country was recorded at 296.65 million tonnes—up by 11.44 million tonnes compared with 285.21 million tonnes in FY19. The government has set a target to buy 42.74 million tonnes from the central pool in FY21; this is 10% more than the quantity purchased in FY20. For FY22, the government has set a record target for farmers to raise food grain production by 2% with 307.31 million tonnes of food grains. In FY21, production was recorded at 303.34 million tonnes against a target of 301 million tonnes.

India's irrigation covered crop area was about 22.6 million hectares in 1951, and it increased to a potential of 90 mha at the end of 1995, inclusive of canals and groundwater wells[3]. However, the potential irrigation relies on reliable supply of electricity for water pumps and maintenance, and the net irrigated land has been considerably short. According to the 2001/2002 Agriculture census, only 58.13 million hectares of land was actually irrigated in India[8]. The total arable land in India is 160 million hectares (395 million acres). According to the World Bank, only about 35% of total agricultural land in India was reliably irrigated in 2010.

Agriculture is the main source of food production in our country. In India, agriculture contributes 18% of the country's Gross Domestic Product (GDP) which employs more than half of the total population. The Indian government has stressed and highlighted the need of innovations to be in above mentioned criteria in agriculture, thus seeking an indication of technology exposure and innovative implementation practices to enhance productivity. The productivity in agriculture, food security, erratic conditions in climates, soil conditions require new ideas and innovations. While this largely depends on the irrigation system, and current techniques in irrigation which helps to achieve more productivity per drop of water. Automation in the irrigation system helps farmers to manage their work much easier and helps to make decisions even in the absence of farmers. IoT, sensors, smart phone tools are the technologies which helps farmers to know the

status of their land, amount of water needed, temperature of soil, humidity, weather conditions, ph level. Smart agriculture is also called precision agriculture. A number of sensing technologies are used in precision agriculture, providing data that helps farmers monitor and optimize crops, as well as get used to changing environmental factors including location sensor, optical sensor, electrochemical sensor, Mechanical Sensors, Dielectric Soil Moisture Sensors, Airflow Sensors, Agricultural Weather Stations, humidity sensors, Proximity Sensor, pH Sensor.
The farmer used different techniques to overcome the wastage of the water during irrigation but it do not meet the expectation. In Order to monitor the irrigation. A mobile integrated smart irrigation system is developed which automates the irrigation by analysing the moisture level of the ground and this system will operate without manual intervention. The motor will turn ON when the moisture level is below the threshold value and turns OFF when the moisture level is above the threshold value.
Irrigation is the fundamental need of agriculture, there are three classic irrigation methods
channel irrigation, sprinkler irrigation and Drip Irrigation according to the need of crops these three methods are being used. Regarding smart irrigation systems, researchers have proven that water usage is minimized when an automated irrigation system that relies on soil moisture as a parameter is implemented. Among this Drip Irrigation is the one where farmers can conserve more water as it will supply the water in the form of droplets directly on to the root of the plant on to the surface of the soil. But to irrigate the plants human continuous attention towards the crops is essential and also manpower is needed to implement any irrigation method. To avoid this using sensors, an automatic method of Drip irrigation can be implemented and the status of the irrigation is updated for farmers using IoT. To implement this we will use Bot Wifi Module which helps to create the alert on farmer devices when the water level reaches the set threshold, soil moisture sensors, LDR sensor etc and by using Twilio messaging app and Bolt Cloud we will create the application.

Types of Irrigation:-

Irrigation using TubeWells:-

The water utilized in state for irrigation is 70 percent groundwater. It is understood that farmers mostly depend on groundwater for irrigation and state tubewells contribute a lot in this process. Before planning years there were total 2343 energized state tubewell and by the end of first five year plan (1951-56) there were total 4734 energized state tubewells. By the end of 12th five year plan (2012-17) year 2015-16 total 39680 tubewells are made energized. In year 1989-90 total operating state tubewells were 26289, which increased to 32047 by 2015-16. At present (dated 01.04.2016) there are total 33375 operating state tubewells, which are making irrigation and cultivation more comfortable to farmers. Out of 33375 tubewells 25205 state tubewells are of 1.5 cusec capacity and 8170 state tubewells are of 1.0 cusec capacity. From these state tubewells total 29.29 lac hectare irrigation efficiency has been created. Beside Irrigation tubewells total 13 state tubewells in Bulandshahar district and 16 tubewells in Aligarh district of Western Uttar Pradesh are being operated from which water could be supplied to canals at the time of water crisis.

Surface Irrigation

In this system, no irrigation pump is involved. Here, water is distributed across the land by gravity.

Localized Irrigation

In this system, water is applied to each plant through a network of pipes under low pressure.

Sprinkler Irrigation

Water is distributed from a central location by overhead high-pressure sprinklers or from sprinklers from the moving platform.

Drip Irrigation

In this type, drops of water are delivered near the roots of the plants. This type of irrigation is rarely used as it requires more maintenance.

Centre Pivot Irrigation

In this, the water is distributed by a sprinkler system moving in a circular pattern.

Sub Irrigation

Water is distributed through a system of pumping stations gates, ditches and canals by raising the water table.

Manual Irrigation

This a labour intensive and time-consuming system of irrigation. Here, the water is distributed through watering cans by manual labour.

CHAPTER-2

Literature Survey

Vaishali et al.,[1] worked on an automatic irrigation system and monitoring system. The system supports water management decisions used for monitoring the whole system using the GSM module. The system continuously monitors the water level in the tank and provides an accurate amount of water required for plant or crop. The system checks the temperature and humidity of soil to retain the nutrient composition of the soil managed for growth of plants. Smartphones are used for communication. In the proposed work, the crops or plants are considered along with their water requirements at different stages. The crops or plants are waters with respect to the water requirements at different stages. The water is passed to the plants as and when required. If the soil is dry an alert SMS is sent "motor on" to the mobile and through the voice or text the water pump is turned off and water flow stops. Here an application that is Blue term is used. These apps totally worked on Bluetooth. To interface the android application and the master robot we require a Bluetooth module. This application is used for writing and coding programming then these programs are sent to the Raspberry Pi. These Sets of code are then given input of a motor which is responsible for the movement of water.

Lala Bhaskar et al., [2] develop an automatic crop irrigation system which aids farmers in the irrigation process. It keeps notifying the farmers through onboard lcd display and message that is sent on the farmers cellular number. The proposed system is also helpful for the farmers who are facing power failure issues to maintain a uniform water supply due to power failure issues to maintain a uniform water supply due to power failure or maintain a uniform water supply. The automatic irrigation system also keeps the farmer updated with all the background activities through the SIM900 module that sends messages on the registered number. This device can be a turning point for our society. The device is easily affordable by the farmers of the country. This proposed design is helpful for reducing human labour. This is a low budget system with an essential social application. This model eliminates human labour completely. Farm automation includes monitoring humidity temperature, water levels of the wells and uniform supply of water using sprinkler and drip water irrigation. This is a low budget system with an essential social application which can be further improved by using the latest technology.

The threshold values are applied in the temperature and soil moisture by using a micro controller based gateway to monitor water quantity. The system can be powered and has a communication link on cellular interface that allows data monitoring and irrigation scheduling through a web page. The innovative system with new technologies in agriculture helps to provide betterment for farmers in increasing the agricultural yield. A remote sensing and control irrigation system using a distributed wireless sensor network was developed. The irrigation rate was measured in the field and linear moving of irrigation system used to maximize the productivity with minimal use of water was developed by the author [3].

The usage of technology in the agricultural field helps to reduce extra man power efforts. The researchers measured soil related parameters such as temperature and humidity. The sensors were put down to the soil and the communication received from the sensors to the relay nodes with the help of communication protocol. The author developed an IoT based system where sensor transmission is done on an hourly basis. The main drawback of this system is they used asynchronous

receiver transmitter interface to receive the signals from sensors, but the sensors were placed in the down of the earth causing attenuation of signals [5].

S Nalini Durga (2018) proposed “Smart Irrigation System Based on Soil Moisture Using Iot” Agriculture remains the sector which contributes the highest to India’s GDP. But, when considering technology that is deployed in this field, we find that the development is not tremendous. Now a day’s there is huge enhancement in technologies which have a significant impact on various fields like agriculture, healthcare etc. Agriculture is the primary occupation in our country. India’s major income source is depending on agriculture therefore the development of agriculture is important. In today also most of the irrigation systems are operated manually. The available traditional techniques are like drip irrigation, sprinkler irrigation etc. These techniques are need to be combined with IoT so that we can make use of water vary efficiently. IoT helps to access information and make major decision making process by getting different values from sensors like soil moisture, water level sensors, water quality etc.

Further, it also provides a facility for irrigation scheduling. The user can schedule the irrigation at a specified threshold value of soil moisture. The system guides to maintain the threshold value based on the predicted pattern of soil moisture and precipitation information. The system can automatically start the irrigation, which stops after achieving the specified threshold value of soil moisture. In this module, a water pump is connected to a relay switch that is controlled by a Wi-Fi enabled node. The node is controlled by the web service through a trigger from the responsive web based interface for real-time monitoring. Using this web based interface the water pump can be managed remotely in manual and auto modes. In the proposed architecture, the WiFi module/Mobile data communication module can be used as communication media between the field device and the server. In this experiment a WiFi module has been used to send the data to the server. WiFi module or Mobile data communication module can be used to send the data from the gateway node to the server.

Proposed System Design:-

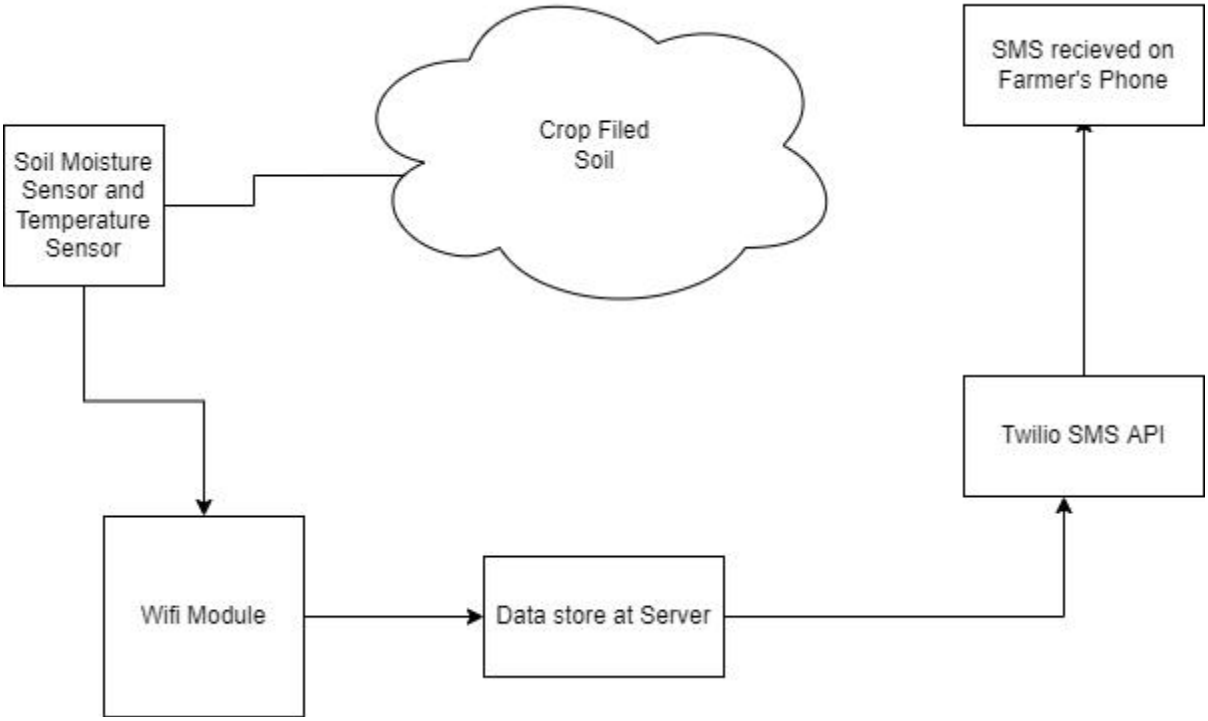


Fig.1 Show the system design for the project.

CHAPTER-3

Requirements And Working Of The Project

Things used in the project:-

Hardware Components:-

2. **Bolt IoT Wifi Module**
3. **L293D Motor Driver**
4. **Submersible Mini Water Pump 3-6V DC**
5. **Breadboard**
6. **Jumper Wires**
7. **Power Bank**
8. **Soil Moisture Sensor**

Software Components:-

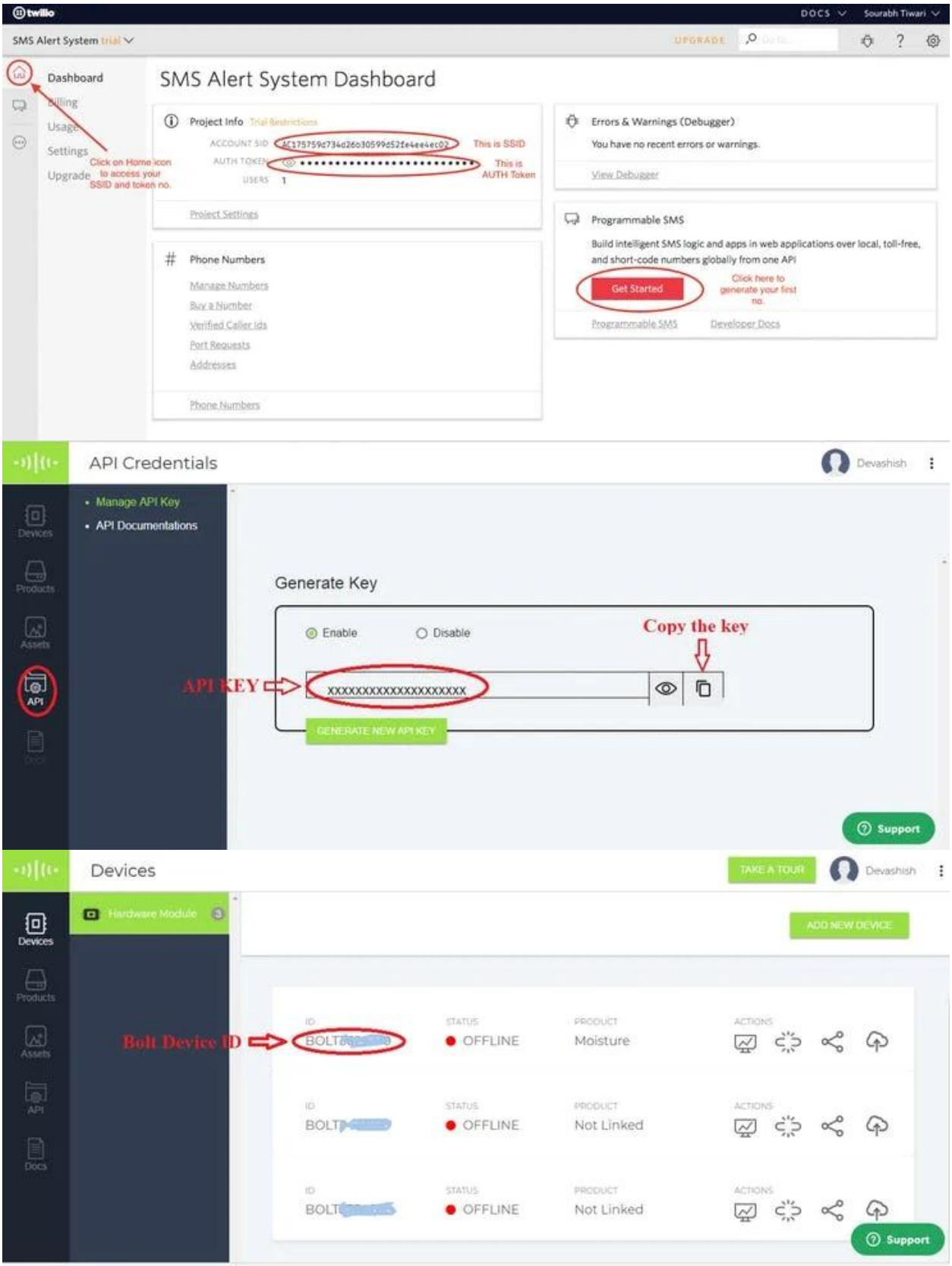
1. **Bolt IoT cloud**
2. **vm ware**
3. **ubuntu server**
4. **Twilio SMS Messaging API**

Implementation:-

Step 1.
Connect all the hardware devices like Wifi module with sensors with help of wires and breadboard.

Step 2.
Connect the Bolt to the cloud after assembling the hardware, register and connect the Bolt unit to the Bolt Cloud.

Step 3.
After building the logic now we need to enter the credentials for the services being used. i.e Bolt device ID and the API key for the BoltIoT service and SSID, Authentication token number, sender's number for the Twilio service. You can find all these at cloud.boltiot.com and twilio.com respectively. Look in the images below for further help.


twilio
DOCS
Sourabh Tiwari
SMS Alert System trial
UPGRADE
Dashboard
Billing
Usage
Settings
Upgrade
Click on Home icon to access your SSID and token no.
SMS Alert System Dashboard
Project Info
ACCOUNT SID
This is SSID
AUTH TOKEN
This is AUTH Token
USERS 1
Project Settings
Errors & Warnings (Debugger)
You have no recent errors or warnings.
View Debugger
Programmable SMS
Build intelligent SMS logic and apps in web applications over local, toll-free, and short-code numbers globally from one API
Get Started
Click here to generate your first no.
Programmable SMS
Developer Docs
Phone Numbers
Manage Numbers
Buy a Number
Verified Caller Ids
Port Requests
Addresses
Phone Numbers
API Credentials
Devashish
Manage API Key
API Documentations
Devices
Products
Assets
API
Docs
Generate Key
Enable
Disable
Copy the key
API KEY
XXXXXXXXXXXXXXXXXXX
GENERATE NEW API KEY
Support
Devices
TAKE A TOUR
Devashish
Hardware Module 3
ADD NEW DEVICE
Bolt Device ID
ID
STATUS
PRODUCT
ACTIONS
OFFLINE
Moisture
Not Linked
Support

Also, fill the required command along with the pin no. for the Bolt IoT service and the required SMS along with recipient's number to be sent for Twilio service.

Step 6.
Do the proper coding and put the particular threshold value to ON and OFF the motor.

config.py

```
SID = 'You can find SID in your Twilio Dashboard'
AUTH_TOKEN = 'You can find  on your Twilio Dashboard'
FROM_NUMBER = 'This is the no. generated by Twilio. You can find this on your Twilio Dashboard'
TO_NUMBER = 'This is your number. Make sure you are adding +91 in beginning'
API_KEY = 'This is your Bolt Cloud account API key'
DEVICE_ID = 'This is the ID of your Bolt device'
```

final.py

```
import conf
from boltiot import Sms,Bolt
import json,time
#this value is your wish based on your plant/farm
treshold_value=25
mybolt=Bolt(conf.API_KEY,conf.DEVICE_ID)
sms=Sms(conf.SID,conf.AUTH_TOKEN,conf.TO_NUMBER,conf.FROM_NUMBER)
while True:
  print("Reading Sensor Value")
  response=mybolt.analogRead('A0')
  data=json.loads(response)
  try:
    sensor_value=int(data['value']))
    sensor_value=(sensor_value*100)/1024
    print("Sensor value is: "+str(sensor_value))
    if sensor_value>treshold_value:
      response=sms.send_sms("The current temperature is: "+str(sensor_value)+"Switching on the water pump to supply water to our farm")
      print("Switching on the motor")
      mybolt.digitalWrite('1','HIGH')
```

```
        print("Motor on successfully")
        time.sleep(30)
        print("Switching off the motor")
        mybolt.digitalWrite('1','LOW')
        print("Motor off successfully")
  except Exception as e:
     print("An error occured")
     print(e)
  time.sleep(100)
```

Step 7.

Project has been implemented successfully.

CHAPTER-4

Result and Discussion

We have successfully implemented our smart irrigation project. We hope that it'll provide help to farmers in irrigation and save their time and increase their yields. It'll help the farmers to switch their tubewell automatically when the field water reaches the specified threshold it will automatically change the state of the motor from ON to OFF and when the soil moisture detected by the soil moisture sensor is below the specified threshold it will change the state of motor from OFF to ON so that farmer's field get water on time.

CHAPTER-5

Conclusion and Future of Scope

Conclusion:-

Smart irrigation is the best technology which will help our farmers in saving their time and in the growth of their crops. Technological development help our farmers in the upcoming days we can build many technologies which can help our farmers to make the farming process easy and conducive which help to increase their crop production and yielding, when the production of crop increase our farmers income will also increase and it will help to increase our country GDP also. IoT based technologies are very helpful. Using different kinds of sensors we can provide the best agriculture approach to our farmers. And it will save their time and decrease their efforts.

Future Scope:-

We can study the future to utilize our sensor in the best and by applying various ML algorithms in order to provide a better product for agricultural development. We can come up with a similar different idea for our farmers to help them. We can further study how we can provide the best technologies for our agriculture sector to save our farmers time and to increase their crop yielding.

CHAPTER-6

References

[1] Lala bhaskar,barkhakoli,punithkumar,vivek gaur "automated crop irrigation system," 2015.

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[3] S. Gangopadhyay and M. K. Mondal, “A wireless framework for environmental monitoring and instant response alert,” in 2016 International Conference on Microelectronics, Computing and Communications (MicroCom), Jan 2016, pp. 1–6.

https://www.boltiot.com/

https://www.twilio.com/docs/sms/send-messages